

Our large Map of Turkistan, comprising the countries between the Caspian Sea and the Punjaub frontier of British India, a space from west to east more than twenty geographical degrees of longitude, presents to view the existing boundary of the Russian Empire, which stretches across this region from Lake Aral to the high table-land above Kashgar and Yarkand; with the Usbek (Tartar) or Turkoman Khanates of Khiva, Bokhara, the Usbek (Tartar) or Turkoman Khanates of Khiva, Bokhara, and Kokan, and with the neighbouring provinces of Persia and Afghanistan. It is the rapid advance of Russian military conquests in the intervening territories of the Usbek and Turkomannations, whose Mohammedan princes have lately becomes on helplessly weak, that now more than ever causes serious alarm to our politicians; either lest these encroachments should be followed by Russian attacks on the frontier provinces of Afghanistan, over which the Ameer of Kabul an ally of the followed by Russian attacks on the frontier provinces of Afghanistan, over which the Ameer of Kabul, an ally of the British Government in India, claims a feudal sovereignty; or else, it is feared, the power of the Czar, already established on the southern and eastern shores of the Caspian, may soon grasp at Persia, and possibly may next take possession of the Euphrates Valley, a projected route of communication between Europe and India. Such being the practical interests at stake in the belief of many well-informed persons, and the subject having been discussed in Parliament on the publication of Earl Granville's diplomatic correspondence with Prince Gortschakoff, we present this map, carefully drawn by Mr. E. G. Ravenstein, as a very useful help to study the Central Asian question.

The lectures delivered by Sir Henry Rawlinson to the Royal Geographical Society; by Brigadier-General Adye, at Marlborough House; by Mr. Iltudus Prichard, to the East India Association; and by the Hon. Mr. Bourke, M.P., at King's Lynn, have been reported in the daily papers, and have diffused much fresh knowledge upon this subject. It is manifestly a very large subject, both in the extent of historical and geographical information required for its due comprehension, and in the magnitude of those issues political military and geographical information required for its due comprehension, and in the magnitude of those issues, political, military, and commercial, which some people think to be involved. One particular feature of the recent controversy between the British and the Russian Governments has engaged a special degree of public notice. It was the disputed sovereignty of our ally Shere Ali, the Afghan lord sovereignty of our ally Shere Ali, the Afghan lord paramount, over two small districts lying north of the mountain range called the Hindoo Kush, at no great distance from the Punjaub and Kashmir. These two little provinces, Badakshan and Wakhan, have seldom been visited by any Europeans; but an old description of them, by the late Captain John Wood, R.N., is now republished, with a geographical essay by Colonel Yule, under the title of "A Journey to the Sources of the River Oxns." The Oxns, or Amu Daria, rising in those parts, below the Pamir table-land, flows westward and north-westward, as shown in our Map, through the dominions north-westward, as shown in our Map, through the dominions of Bokhara and Khiva, to the inland Sea of Aral. It is apprehended by some British statesmen or military men that the Russians, when they have seized Khiva and Bokhara, as well as the third Khanate—that of Kokan—will proceed to lay hold on these Afghan provinces, which would bring them disagreeably near to our Punjaub frontier.

We have been favoured by a correspondent with the following remarks upon the present aspects of the question:

"To anyone who has studied the nature of the agreement

"To anyone who has studied the nature of the agreement arrived at between Lord Granville and Prince Gortschakoff with regard to the frontier of Afghanistan, and also the explanations of its purport which have recently been vouchsafed to us in Parliament by the representatives of the India and Foreign Offices, it must be painfully apparent that this so-called settlement has in reality settled nothing at all. If it was necessary as yet to fix the precise boundaries of Northern Afghanistan, it was surely an essential condition of such an arrangement that the line of demarcation should, in a geographical point of view, be so clearly defined as hereafter not to admit of the possibility of a doubt as to what territories lie on each side of it. But, instead of this, a river is fixed upon just at that part of But, instead of this, a river is fixed upon just at that part of its course where it runs through an utterly unknown and barbarous region, in which no European has for the last five-and-thirty years, owing to the fierce fanaticism of the inhabitants,

barous region, in which no European has for the last five-andthirty years, owing to the fierce fanaticism of the inhabitants,
been able to set his foot.

"Now, it was specially stipulated by Lord Granville that
the provinces of Badakshan and Wakhan should be included in
Afghanistan, on the ground that the Ameer Shere Ali rightly
considered them part and parcel of his territories. At the
same time, Shere Ali's rights are, according to Mr. GrantDuff's statement in the House on February 21, only to be
recognised up to the southern bank of the Oxus. But upon
closer inquiry it turns out that nothing definite is known as to
whether the northern frontier of Badakshan extends beyond
the Oxus or not; while with regard to Wakhan, so great is the
ignorance concerning it, that even among the best geographical
authorities it is a matter of doubt as to whether it is upon the
right or left bank of the river. If Wakhan is on the southern
bank of the Oxus, and Shere Ali has rights of sovereignty over
it, well and good. If, however, it is on the northern bank—
which, it may be said, is the position assigned to it in most
maps—and we refuse, though acknowledging his right to
Wakhan, to recognise his rights of sovereignty beyond the
river, he may well complain that we are not only inconsistent,
but that, in our undue haste and anxiety to come to an understanding with Russia, we have not scrupled to sacrifice his instanding with Russia, we have not scrupled to sacrifice his in-terests, and he may reasonably object to the dismemberment of his kingdom in this manner. It is evident that a boundary line that has been drawn upon such very insufficient data, and which is open to such uncertain interpretations, may easily give rise to grave complications at a future date.

"Again, no rational man can doubt that, by thus fixing the

boundary of the proposed intermediary zone, we have virtually secured to Kussia an area of future conquest as wide as she can profitably occupy for the next fifteen or twenty years, and have by our own act deprived ourselves of any right of remonstrating with her regarding any fresh annexations she may deem fit to make north of the Oxus. In other words, she can now advance virtually by treaty instead of by force of

"With regard to the contemplated Russian expedition against Khiva, which will be set on foot at the end of the current month, it is now stated that the force it is intended to employ will consist of ten or twelve thousand men, with artillery. Owing to the scarcity of water along some portions of the routes to be traversed, and also the difficulty of transport, the expeditionary force will be divided into three columns, which will start from three different points, and will converge upon Khiva from the north, the east, and the west—viz., from Orenburg, from Krasnovodsk, on the Caspian, and from Djazak, in Turkistan. Humanly speaking, there can of course be no doubt of its success. Whether the Russian Government will permanently annex the country it is as yet

British dominions in Hindostan is the wildest and silliest notion that ever found place in an ignorant mind. It is by a march of several thousand miles, across the most desolate regions of two vast continents, at the very back of the world, and for many hundred miles across the uninhabited desert, that the Czar's troops would have to reach the banks of the Indus. Here they would be confronted not only by 200,000 of the finest soldiers, European and native, perfectly equipped and supplied, in the ordinary service of British India, under the best officers in the world, but also by the freshly-landed regiments from England, which could be sent to Bombay in three or four weeks by the Suez Canal, upon receipt at Westminster of an electric message in five hours from Lahore! A war under such conditions of inequality, now that the Punjaub railways are being laid well up nequality, now that the Punjaub railways are being laid well up to the frontier, is utterly inconceivable; but let it be remembered, wither, that the Czarlost half a million of soldiers in the Crimean War, mostly from their fatigue, starvation, and exposure to weather on the march through South Russia; then what would be the losses of the Russian army on its route from St. Petersburg to the Khyber Pass? The idea is altogether too absurd burg to the Khyber Pass? The idea is altogether too absurd for a serious confutation; but we do not mean to deny the importance, in a political view, of Russian conquests in the East, and more especially at Kokan and Bokhara. The Mohammedan rulers of those places have for ages possessed a considerable amount of influence over their co-religionists in Central and in Southern Asia. If they were brought into absolute subjection to the Russian empire, and forced to subserve its designs of aggrandisement, they might be capable of stimulating intrigues, conspiracies, and rebellions among some of the hill tribes on our Indian frontier, secretly connected with a traitorous and fanatical sect in Bengal and the North-western Provinces, hostile to the British Government. This, at least, is the conclusion we draw from the statements of Mr. Hunter, of the Bengal Civil Service, in a book lately noticed, and from all that we are told we draw from the statements of Mr. Hunter, of the Bengal Civil Service, in a book lately noticed, and from all that we are told of the religious and political tendencies of Asiatic Mohammedanism. The Sultan of Turkey, who was so magnificently entertained at the India House, when in London a few years ago, seems to have no authority as "Commander of the Faithful" in that part of the world. "Bokhara and not Mecca," says Arminius Vambery, "had become practically the spiritual centre of Islamism," long before that day, May 14, 1868, when the Russians captured the famous town of Samarkand, once the splendid capital of Timour or Tamerlane. Of Professor Vambery's learned "History of Bokhara," and of his previous travels in Central Asia, we have spoken in former previous travels in Central Asia, we have spoken in former notices. To these and other books our readers may turn for nstruction, with the map now set before them.

Mr. Marwick, Town Clerk of Edinburgh, has been appointed Town Clerk of Glasgow, at a salary of £2500 per annum.

The Queen has approved of Mr. John Forbes White as Consul at Aberdeen for the King of the Belgians.

Mr. T. Taylor, of Aston Rowant, Oxon, has given £5000 to the Town Council of Wigan for the foundation of a free library. The Civil Service Estimates for the current year show a total of £18,419,698; a net increase of £444,625 upon the amount voted in 1872.

The Lord Chancellor reports that the right of Baron Clarina vote for the election of representative peers for Ireland has

The Glasgow Association of Underwriters has passed a resolution approving of Mr. Plimsoll's efforts to reduce the loss of life and property at sea, and hoping he will introduce a bill to prevent deck-loading and overloading.

The Mid-Cheshire election (the first English county election under the ballot) has resulted in the return of the Conservative eandidate, Mr. Egerton Leigh. The numbers being-Leigh, 3508; Latham, 2118.

Mr. Roebuck was present on Monday evening at a banquet given at the Cutlers' Hall, Sheffield, to commemorate the twentieth anniversary of the establishment of the Sheffield and Hallamshire District of Foresters. The chair was occupied by impossible to foretell. In any case, Russia will retain certain strategical points in this country, which will give her a right of way from the Caspian to her most westerly provinces in Turkistan. She will also probably retain the command of both banks of the Oxus, so as to be able to the Mayor of Sheffield (Alderman Fairburn), and there was a

organise and improve the navigation along its whole course through Khiva, from its embouchure in the Oral Sea as far up, as it may be convenient or practicable for the robat to ascentilly as the convenient or practicable for the robat to ascentilly drawn. It is a project which it is a far greater object for the convenient or present in a drawn we think that public attention has not, as yet, been sufficiently drawn. It is a project which it is a far greater object for the convenient of the convenient of the convenient of badakahan and Wakhan. We refer to her contemplated advances dong the northern bank of the Atrest, two which as the convenient of badakahan and Wakhan. We refer to her contemplated advances along the northern bank of the Atrest, will not a settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and how the the principal settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and how the the principal settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and how the the principal settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and how the the principal settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and will will have prevent the settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and will will have prevent the settlement at Kransrovodak Bay, which hitherto has been the head-quarters of the troops on the easter and will will have prevent the settlement at Kransrovodak and of the Musical Translorment of the Musical Capital and the settlement at Kransrovodak and of the Musical Translorment of the Musical Capital and the settlement at Kransrovodak and the settlement at Kransrovodak and the settlement of the settlement o

result being that a small quantity of pure molasses is obtained, the rest of the sugar being converted into loaves.

The discussion of the three rival vessels of Bessemer, Dicey, and Mackey, for the performance of the voyage between France and England, has during the past month been prosecuted at the Society of Arts with unabated interest. But we concur in the opinion expressed by the gallant Admiral who presided, that it is very doubtful whether any of these designs will be the type eventually adopted. Hydraulic propulsion, it is well known, is less efficient than propulsion by a screw or by paddles; and twin vessels, it is also known, are more difficult to drive than good vessels of the ordinary type having equal carrying power. Nor do we see how it is possible that vessels intended to maintain a very high speed on a draught of water of only eight feet can be made to pay, as they will find it difficult enough to carry their engines, boilers, and fuel, without being loaded with any other weights. The establishment of better and deeper harbours is the indispensable antecedent of an efficient Channel service; and it appears very much like a camel going through the eye of a needle for vessels of the great breadth proposed by these inventors to run in heavy weather, so as to accurately enter the narrow entrances of Calais or Boulogne. Even the present small boats now employed do not find it too easy to do this; and, to our apprehension, vessels of greatly superior size could not be set to run regularly between these contracted ports without considerable danger.

India or China grass-cloth, a fabric long known as a sort of Oriental coving the likely to become

India or China grass-cloth, a fabric long known as a sort of Oriental curiosity, is likely to become an extensive article of commerce, the cultivation of the plant which yields the material having been begun in some of the Southern States of America in substitution of cotton and sugar-cane. The China grass, or ramie, as it is called, is a plant of the nettle tribe, and the fibre is the inner bark of the stem. This fibre has a silky appearance, it takes dye well, is stronger than flax, and may be easily worked up with wool to form light fabrics. It felts better than wool and the plant grows freely and appearance. felts better than wool, and the plant grows freely and appears to be exempt from insect enemies

to be exempt from insect enemies.

We have on several occasions referred to the importance of providing steam life-boats for service upon our coasts, as not merely ensuring greater efficiency, but as risking the lives of the minimum number of persons. Such a life-boat has lately been projected by Mr. W. Petersen, a seaman of some experience in life-boat operations. But the mechanical arrangements of the design are in our judgment imperfect. The boiler is hung on gimbals, and the propulsion is effected by a screw at each quarter. The boiler should, in our judgment, be a vertical tubular boiler, with a chimney of sufficient height covered by a cap, and a steam blast to maintain a good draught. The screws, we fear, would be sometimes out of the water. For a purpose of this kind hydraulic propulsion should be adopted, for the centre of the boat, where the water yould be taken in, would be always in the water, and the water jet would act whether the stern of the boat was out of the water or not.

Among the remarkable evidences of progression in Japan is

Mr. George March has been appointed to succeed the late Mr. John Brodribb Bergne as Superintendent of the Treaty
Department of the Foreign Office.

Mr. J. G. Lewis of the boat was out of the water or not the institution of a patent law. Inventors may now patent their discoveries in that country.

Mr. J. G. Lewis of Ch.

Mr. J. C. Lawrie, of Glasgow, has offered himself as a candidate for the engineering chair in Glasgow College, rendered vacant by the lamented death of Professor Rankine.

The Danks rotary puddling-furnace has been put into operation at the works of Hopkins, Gilkes, and Co., with satisfactory results. The squeezer is able to deal with half-ton blooms. But there is no rolling-mill at hand able to deal with such large masses. In connection with this puddling-furnace reversing-mills should be employed, which are able to roll the iron backward and forward without the necessity of taking it back over the rolls.

Prussia proposes to build eleven armourclads, eleven corvettes, and three despatch-boats, which are to be finished in 1877, at an estimated cost of £4,000,000 sterling. It is to be hoped that an example will be shown by these armourclads large attendance. In the course of his speech Mr. Roebuck denounced the strike in South Wales, and declared that the shot out that could be fired from any gun now existing, with a satisfactory margin for the future.

whole, a favourable view of our position in India, recommending a cordial alliance with Afghanistan and Persia, and the free admission of natives to civil and military office. Mr. Hughes's lecture on the "Problems of Civilisation" is vigorously expressed. Mr. Furnivall gives an interesting account of the work done and doing by the Chaucer Society; and Mr. Lang expounds the dubious hypothesis of a modern Peruvian ethnologist, who traces his Indian fellow-countrymen to the Aryan

MARCH 15, 1873

The most interesting contribution to Blackwood is a retrospective notice of Lord Lytton's career as a novelist, written from a most favourable point of view, of course, yet with signal ability. Doubtful as may be Lord Lytton's claims to the first rank, yet, from the versatility of his talent, few have afforded more openings for handsome encomiums on the part of kindly critics. "The Parisians," though still uninteresting as a story, is extremely well written, and displays much political good sense, which would be all the more impressive for being more largely leavened with political morality. Even just reflections and shrewd aphorisms lose their effect when propounded in the interest of so demoralising a system as that of the Second Empire. The "True Reformer" is now actually installed in the War Office, diligently at work upon reforms which, we suppose, embedy the actual recommendations of the author of this year. embody the actual recommendations of the author of this very

Fraser has a lively and sensible paper on "The Causes of Friction between the United States and England," summed up in the happy phrase, "The English are the most irritating and the Americans the most irritable people in the world." Sir R. Alcock's sketch of the average contents of the Pekin Gazette depicts in glospay colours the ground description of the opening. depicts in gloomy colours the general decrepitude of the empire; and Mr. Macdonell's ironical vindication of St. Bartholomew is striking, in virtue of its caustic vigour. "Our Seamen" is chiefly made up of extracts from Mr. Plimsoll's book. General Cluseret's paper on the Commune adds little to our knowledge of the subject, while it deals as largely as usual in glorification of the writer and vituperation of everybody else. Before the General had written a line we felt, no doubt, that he had actually played an important part in the Parisian insurrection. He has by this time almost convinced us that his part was that of the fly on the wheel.

In the Contemporary Review Mr. Herbert Spencer examines the respective influence of a patriotic and an anti-patriotic bias the respective influence of a patriotic and an anti-patriotic bias in influencing speculation with regard to strictly sociological questions. Mr. Arnold is taken as the example of the latter tendency, and Mr. Spencer certainly seems to succeed in showing that his assumption of a natural indifference of the English intellect to ideas is too hastily made. Mr. Goldwin Smith, treating of Ireland, Mr. Greg of unproductive expenditure, Mr. Ludlow of friendly societies, and Mr. A. Mills of Canada, all discuss subjects where they are thoroughly at home. We hardly know whether to say as much of Mr. Ruskin when he gets on the subject of miracles. In the first part of his paper he maintains whether to say as much of Mr. Ruskin when he gets on the subject of miracles. In the first part of his paper he maintains that, the uniformity of nature not being established, the most startling apparent departures from it could be attended by no evidential effect; in the second he rallies the clergy on their inability to work miracles. The essay is nevertheless full of fine things, as for example—We breathe with regularity, and can calculate upon the strength necessary for common tasks; but the record of our best work and of our happiest moments is always one of success which we did not expect, and moments is always one of success which we did not expect, and

moments is always one of success which we did not expect, and of enthusiasm which we could not prolong.

The question, "Are we Christians?" is discussed by Mr. Leslie Stephen, in the Fortnightly Review, with spirit and suggestiveness; but he returns no definite answer. Mr. F. Galton, in an essay on "The Causes which Create Scientific Men," replies to some observations by M. Decandolle, the Genevese botanist, who considers that he has over-stated the destriction of heading the interview of the stricture of the s loctrine of heredity. It is certainly exceedingly difficult to draw the line between physical predisposition and social causes in the inheritance of ancestral peculiarities. Dr. Sandwith contributes a very favourable report of the condition and prospects of Servia; Mr. A. H. Beesly a vigorous attack on the game laws; and Mr. Gairdner an account of the incident which led the imputation of cowardice to be fastened upon the really intended original of Shekanagara Falatets.

led the imputation of cowardice to be fastened upon the really intrepid original of Shakspeare's Falstaff. A brief but pithy review by Mr. J. S. Mill introduces Signor Constantino Baer, an Italian economist who advocates a graduated tax upon capital, instead of, as usually suggested, upon income.

The Atlantic Monthly contains two contributions of unusual interest—Mr. Parton's description of the first Cabinet of General Washington, and of the general state of affairs in the United States on Jefferson's return from his Parisian embassy, and Mr. R. D. Owen's reminiscences of his father at New Lanark. The most interesting contents of the Transatlantic are reprinted from the Atlantic Monthly.

In Temple Bar, hesides Mr. Collins's and Mrs. Edwards's

In Temple Bar, besides Mr. Collins's and Mrs. Edwards's stories, we have a fairly-written critique on Lord Lytton, justly claiming credit for him on the score of versatility and perpetual freshness, and as, in his historical romances, the nearest representation of Scott, but omitting to advert to the essentially artificial nature of his talent. A paper on Edward Wortley Montagu recounts in lively fashion the strange adventures of one of the men who have most contributed to fix the imputation of eccentricity on travelling Englishmen. The hero of "Roots" succumbs to fate, after having, like most dying heroes, expressed himself at much greater length than he was accustomed to do

while in health.

The Month has several interesting papers. A professed apology for the divided allegiance of Roman Catholics seems, on the whole, to admit the charge, and to glory in it. An analysis of the views of Catholic casuists on tyrannicide establishes an unexpected degree of liberality (since discountenanced) on the part of some of them, and shows that the views for which the Jesuits were reproached were shared by many Protestant writers. "Among the Prophets" affords some suggestive glimpses of the style of feeling and discussion current in Catholic and Anglo-Catholic circles: and the article on the n Catholic and Anglo-Catholic circles; and the article on the history of the Italian kingdom contains some interesting

Saint Pauls has some very amusing papers, among which Mrs. Haweis's article on the ballet and the caustic description of the perplexities of a school board may especially be noted. In the Gentleman's Magazine we have to note the completi of Mr. Hatton's "Stranger than Fiction" and the commencement of a new novel by him, "Clytie," which promises equally well. Mr. Cowden Clarke commences a new series of his Tinsley, Belgravia, and the St. James's Magazine are readable enough, but contain nothing of special mark. is as amusing as usual; its observations on Mr. Charles Reade's

## ROYAL INSTITUTION LECTURES.

ORIGIN AND NATURE OF COAL. Mr. A. Vernon Harcourt, F.R.S., secretary of the Chemical Society, gave the first of a series of five lectures on the Chemistry of Coal and its Products on Thursday week. He began by remarking that the coal formation lies immediately above the carboniferous limestone, the highest of the palæozoic series; that its total depth is very considerable, although any particular stratum is seldom very thick; and that the formation consists of a number of thin layers of coal interspersed with consists of a number of thin layers of coal interspersed with deposits of shale. He then demonstrated that coal is of vegetable origin, pointing out its similarity to charcoal, and showing, by means of the microscope and the limelight, that thin slices of coal show distinct organic texture, resembling that of wood. It is imagined that the coal plants (principally gigantic ferns, horsetails and mosses) grew when the earth was just rising from the water, in a warm, moist air; that they died and decayed, and were succeeded by fresh plants, and thus the vegetable matter accumulated for ages. If the land emerged from the water by periods of gradual rising, followed by periods of sinking, water would again cover the coal, and deposits of the mineral matter it held in suspension would take place, and thus the broad bands of shale would be formed. Mr. Harcourt gave reasons for objecting to the theory of some German geologists, that the coal formation is the result of vegetable deposition at the bottom of the sea. He then referred to the results of the analysis of various kinds of coal, and showed that deposition at the bottom of the sea. He then referred to the results of the analysis of various kinds of coal, and showed that Newcastle caking coal consists of carbon, 81'4; hydrogen, 5'8; nitrogen, 2'1; sulphur, 0'8; oxygen, 7'9; and ash, 2'1. The change of wood into coal is probably partly due to the heightened temperature occasioned by decomposition; thus decaying damp hay sometimes takes fire spontaneously. Moreover, as coal was formerly at a much greater depth than it is now, the beds were subjected to much greater heat, and to the various consequences of volcanic action. Mr. Harcourt, after proving by experiment that coal mainly consists of carbon and hydrogen, alluded to its great importance as a reducing agent in metallurgy and in the alkali manufacture, of which he gave striking illustrations.

TEMPERATURE OF THE SUN. Mr. James Dewar, F.R.S.E., at the Friday evening meetng, March 7, began by referring to the recent discussion or he temperature of the sun—10,000,000 deg. Centigrade, acthe temperature of the sum—10,000,000 deg. Centigrade, according to Secchi; 2,500,000 deg., Ericsson; 30,000 deg. Lane; 14,000 deg., Thomson; 27,000 deg., Zöllner; 30,000 deg., Vicaire, Becquerel, and Deville; and 1398 deg. Pouillet. He then explained and illustrated, by novel and ingenious experiments, the various methods employed by physicists for obtaining a knowledge of high temperatures and the principles on which they are based. These are—1, the expansion of solids and gases, adopted by Guyton and Daniell; 2, the refrangibility of light, by Draper and Stokes; 3, specific heat, by Clement, Desormes, and Deville; 4, thermo-electricity and electric conductivity, by Becquerel, Siemens, and Tait; 5, luminous intensity, by Herschel and Tyndall; 6, the explosive power of gases, by Bunsen and Zöllner; 7, the relation between radiating and absorbing power, by Kirchhoff; 8, radiation, by Newton, Ericsson, Secchi, and Waterston; 9, the mechanical equivalent of heat, by Thomson and Helmholtz; 10, dissociation, by Deville and Debray; and, 11, the rate of cooling, by Dulong and Petit. Amongst the illustrations was the permeability of metals by gases at high temperatures, shown by placing a piece of sheet palladium in a hydrogen flame about the middle of the inner cone, proving that the metal was then in an active state of vibration from the continuous alteration of its composition. In respect to the explosive power of gases, of its composition. In respect to the explosive power of gases, Mr. Dewar employed an apparatus devised by himself, the essential feature in which was the registration of the compression volume of a given quantity of air, on which the gaseous explosive mixture was allowed to act, and which was shown to be available for obtaining determinations under varying conditions of temperature and pressure. After pointing out various sources of error in the modes by which the solar temperature has been hitherto obtained, Mr. Dewar showed how it is perature has been hitherto obtained, Mr. Dewar showed how it is possible from the known luminous intensity of the sun to derive a new estimate of its temperature, his calculation being based on a definite law connecting temperature and luminosity in the case of solids—viz., that the total luminous intensity is a parabolic function of the temperature, above that temperature where all kinds of luminous rays occur; a formula which empirically expresses the results of observation. Thus, at a temperature of 2100 deg. C. the total luminous intensity will be about 500 times that which it was at 1037 deg. C. As the temperature of the lime in the oxy-hydrogen flame does not exceed 2100 deg., and as it is known, from Fizeau and Foucault's experiments, that sun-light has 150 times the intensity, we only require to calculate at what temperature this intensity is

experiments, that sun-light has 150 times the intensity, we only require to calculate at what temperature this intensity is reached to get the solar temperature. This is found to be, in round numbers, 13,000 deg. C., which shows that enormously high temperatures are not required to produce great luminous intensities; and Sir William Thomson, in his celebrated article on "The Age of the Sun's Heat," says, "It is almost certain that the sun's mean temperature is even now as high as 14,000 deg." The speaker next explained a formula which gives approximatively the relation between the temperature of a solid and the total amount of radiant power. Knowing as we do the amount of heat conveyed by the sun, it is easy to calculate the temperature required to perform the amount of radiant work. This is found to be 11,000 deg. C. The equations given are, properly speaking, results expressing the increase of intensity in the case of the mean wave-length; but it is probable that a similar function will hold for the individual rays. In conclusion, Mr. Dewar, after referring to the highest hypothetical temperature that can be produced by the chemical combination of the most energetic elements, if all the heat evolved were of the most energetic elements, if all the heat evolved were thrown into the product (which in the case of silica would not exceed 19,500 deg., and in the oxides of aluminium and magnesium 15,000 deg. C.), exhibited the way by which he endeavoured to estimate the heat of the electric spark, stating that the temperature in his experiments ranged between 10,000 and 15,000 deg. C. The president, Sir Henry Holland, Bart., was in the chair.

THE PHILOSOPHY OF SPACE AND MOTION.

Professor W. K. Clifford, M.A., devoted his second lecture well. Mr. Cowden Clarke commences a new series of his always-acceptable Shakspearean papers; and Mr. Blanchard Jerrold's sketch of "Gustave Doré at Work" is interesting.

on the Philosophy of the Pure Sciences, given on Saturday last, to the consideration of certain postulates laid down in Euclid's "Elements of Geometry." This book, he said, has been for nearly twenty-two centuries the encouragement and guide of scientific thought; through it was obtained a body of knowledge that was really known and could be relied on, and that led every scientific student of every subject to bring his last literary controversy particularly so. In Good Words we have to remark a striking poem by Miss Betham-Edwards; and in Good Things a fine version of a Servian legend by Mr.

J. T. Naaké. and in Good Things a fine version of a Servian legend by Mr.

J. T. Naaké.

We have also to acknowledge the Victoria Magazine, the Monthly Packet, the New Monthly, the Dublin University Magazine, Chambers's Journal, Once a Week, the Sunday Magazine, the Popular Science Review, and Cassell's Magazine.

Atter presiding for nearly eight centuries, Euclid which it had now attained. Of the extent of work in the telework in the theory and goodness of Europe; and when he returned again, and became an authority, he was (like Aristotle and Ptolemy), subjected to the criticism of first principles; in his case by Lobatchewski, who, with Copernicus, brought about a great revolution in

scientific thought. Their predecessors held the universe to be scientific thought. Their predecessors held the universe to be a known thing: the earth was a globe in the centre of the universe, heaven a sphere concentric with it, the sun and stars moving in crystal spheres between. If there were anything beyond, it was a void space. The history of all this was traced back to a definite time, and a changeless eternity beyond it needed no consideration. The Copernican system and consequent astronomical discovery have replaced this little knowledge by a great deal more; but it is only the knowledge of Here and Now—the There and Then we do not at all know now, though we may know at some time. The geometer of to-Here and Now—the There and Then we do not at all know now, though we may know at some time. The geometer of to-day knows nothing about the nature of existing space at an infinite distance, or about the properties of this present space in a past or future eternity. Professor Clifford then proceeded to consider the four postulates of the pure science of space and motion: I, Continuity, according to which two adjacent portions of space, or of a line, have the same boundary; and between every two points on a line there is an infinite number of intermediate points; space is a continuous aggregate of points, and not a two points on a line there is an infinite number of intermediate points; space is a continuous aggregate of points, and not a discrete aggregate; 2. Elementary flatness (even of curved surfaces), which is assumed by Euclid when he says "all right angles are equal;" 3, Superposition, according to which a body can be moved about in space without altering its size or shape; and, 4, Similarity, according to which any figure may be magnified or diminished in any degree, without altering its shape. Lobatchewski supposed that the three first postulates are true, but not the fourth. Riemann, however, first accomplished the task of analysing all the assumptions of geometry and showing but not the fourth. Riemann, however, first accomplished the task of analysing all the assumptions of geometry and showing which of them are independent. This very disentanglement was sufficient to deprive them for the geometer of their exactness and necessity. After considering and illustrating these four postulates at some length, Professor Clifford arrived at the conclusion that they are not known to be true, in virtue of our consciousness 1. The same faculty which tells us that space is continuous tells us also that water is continuous, which examination by the microscope contradicts; and what happens on "the wheel of life" is discovered by stopping the machine. Even apart from our knowledge of the way nerves act in conveying messages, it appears that we have no means of knowing Even apart from our knowledge of the way nerves act in conveying messages, it appears that we have no means of knowing anything more about an aggregate than that it is too finegrained for us to perceive its discontinuity; and, 2, The smoothest polished surface that can be made is most completely covered with the minutest ruts and furrows. In conclusion, the Professor described what he considered the nature of things would be on the supposition that the curvature of all space is nearly uniform and positive; adding that upon this hypothesis the whole of geometry would, in his opinion, be far more complete and interesting. complete and interesting.

THE HUMAN VOICE.

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Professor Rutherford, M.D., in his ninth lecture on the Forces and Motions of the Body, on Tuesday last, described the organ as the most perfect of wind instruments. In an ordinary reed, such as that of a concertina or harmonium, the sound is not produced immediately by the vibratory reed, but by the influence of the reed upon the air. The reed modifies the stream of air so as to make it resemble a series of puffs, and thus the note is produced. In the larynx the vocal cords give rise to notes in the same way, since they convert the stream of air through the glottis into an unequal stream, consisting of a succession of rarefactions and condensations. After explaining and illustrating what are termed overtones (harmonics) by means of the vibrations of a string over a sounding-box (the monochord) attached to a limb of a large tuning-fork, and illuminated by a beam of the lime-light, the Professor said that the human voice is rich in these overtones, and that to their variety is due the distinguishing quality of certain voices. The first overtone is an octave above the fundamental tone, the second a twelfth, the third a second octave, and so on. A sound is never produced without overtones simultaneously arising; and the mixture is termed a "clang," and the character of the clang is termed its colour or tint. The human voice contains from six to eight appreciable overtones. The effect of resonance upon the notes produced in the largony was silles. contains from six to eight appreciable overtones. The effect of resonance upon the notes produced in the larynx was illustrated by means of tuning-forks and organ-pipes; and it was shown that resonators (hollow bodies) intensify a note of the same pitch as their own. The lungs, mouth, nose, and pharynx act as resonators for the voice. The Professor stated that a resonator may intensify the fundamental tone or one of the overtones of a clang; and when he sounded the vowel to the content of the con resonator may intensify the fundamental tone or one of the overtones of a clang; and when he sounded the vowels to a tuning-fork, although the pitch remained the same, in all the cases it appeared to rise. This was due to the difference in the shape of the mouth in pronouncing the sounds, whereby different overtones were intensified. He said that one of the most difficult things to learn in singing is the production of proper resonance, by putting the tongue, lips, and lower jaw into the proper positions for resonating rightly; and he suggested that the rise of the larynx during the production of a high note, and its fall during the production of a low note, may be for the purpose of altering the size of the mouth and throat resonator so as to adapt it for notes of a different pitch. Muller has shown so as to adapt it for notes of a different pitch. Muller has shown that this rise and fall does not affect the pitch of the voice. In conclusion, the Professor considered and illustrated the production of falsetto and chest voices.

On Friday evening next, March 21, Captain G. D. Lyon will give a discourse on the Mythology of India, illustrated by dissolving photographic views of the temples; and on Saturday next Professor Max Müller will begin a course of three lectures on Mr. Darwin's Philosophy of Language.

Mr. Henry Brown, who recently presented £5000 for the purpose of founding scholarships in connection with the Bradford Grammar School, has given another thousand pounds to assist promising boys in the junior department.

At a meeting of the Liverpool Local Marine Board, on Thursday week, Captain W. H. Thompson, steam-ship Oceanic, White Star Line, was presented with a gold watch, bearing the following inscription:—"Presented by the President of the United States to Captain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain Facilities and the control of the Captain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain Facilities and the control of the Captain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain Facilities and the control of the Captain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain Facilities and the control of the Captain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in rescuing the crew of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in the control of the American ship, Mountain W. H. Thompson, in acknowledgment of his services in the control of the contr tain Eagle, on Feb. 8, 1872."

Mr. Scudamore, C.B., delivered, yesterday week, in Queen-Mr. Scudamore, C.B., delivered, yesterday week, in Queen-street Hall, Edinburgh, the closing lecture of the present series at the Philosophical Institution, in presence of a large audience. His subject was "On a Co-operative Society." He explained that the society to which he referred covered the entire king-dom; that it was a great joint-stock company, in which all the inmates of the land were shareholders; that it was a society which had the Post Office and the institutions affiliated to the Post Office as its agents and as the exponents of its principles. He sketched, in graphic terms, the early history of the Post Office, contrasting that office as it had been with the results to which it had now attained. Of the extent of work in the tele